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### **Simultaneous Multi-filter Optical Photometry of GEO Debris**

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Information on the physical characteristics of unresolved pieces of debris comes from an object's brightness, and how it changes with time and wavelength. True colors of tumbling, irregularly shaped objects can be accurately determined only if the intensity at all wavelengths is measured at the same time. In this paper we report on simultaneous photometric observations of objects at geosynchronous orbit (GEO) using two telescopes at Cerro Tololo Inter-American Observatory (CTIO). The CTIO/SMARTS 0.9-m observes in a Johnson B filter, while the 0.6-m MODEST (Michigan Orbital DEbris Survey Telescope) observes in a Cousins R filter.

The two CCD cameras are electronically synchronized so that the exposure start time and duration are the same for both telescopes. Thus we obtain the brightness

as a function of time in two passbands simultaneously, and can determine the true color of the object at any time. We will report here on such calibrated measurements made on a sample of GEO objects and what is the distribution of the observed B-R colors.

In addition, using this data set, we will show what colors would be observed if the observations in different filters were obtained sequentially, as would be the case for conventional imaging observations with a single detector on a single telescope.

Finally, we will compare our calibrated colors of GEO debris with colors determined in the laboratory of selected materials actually used in spacecraft construction.